KILLIAN'S RADICAL OPERATION FOR CHRONIC FRONTAL SINUSITIS, WITH DEMONSTRATION OF CASE.*

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DURING my recent visit in Germany I spent some weeks in Freiburg at Professor Killian's Clinic, where I witnessed Killian's direct method of bronchoscopy carried out by introduction of long tubes through the natural breathing channels into bronchi of the second and third order. The instruments which I brought for the use of the Cooper Medical College are open to inspection and may be utilized by any one of this Society.

Before proceeding with the history of this case, permit me to give a short resume of Professor Killian's method of radical operation for chronic frontal sinusitis. Two publications have appeared on this topic, one from the pen of Dr. Krauss, former assistant in Professor Killian's clinic in Frieburg, the other from the pen of the author of this method himself. Both have appeared in the 13th volume of *Archives of Laryngology and Rhinology*, edited by Professor Frankel, with excellent illustrations of the operative methods. From the beginning it was Professor Killian's endeavor to improve the methods for the cure of chronic frontal sinusitis to such an extent that they could not only lead to a certain cure, but would give the best possible cosmetic result. Of the twelve cases, most interestingly and carefully described by Dr. Krauss, the first one was operated on in '96. Killian had then recognized that only by absolutely sacrificing the anterior as well as the lower wall of the frontal sinus,

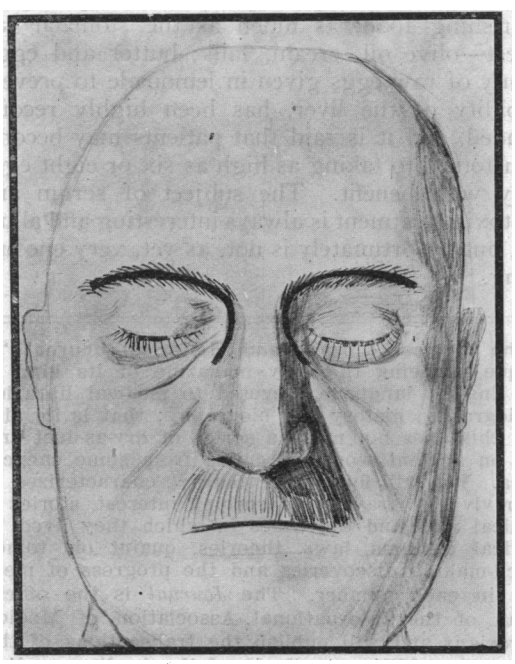

Fig. I.—Heavy lines indicate incision.

could a certain cure be expected. "Only such a radical proceeding," he says, "is in unison with the principles of modern surgery with regard to the treatment of abscesses in rigid walled cavities." To change a complicated cavity into a flat surface it was necessary to completely obliterate the rigid walled frontal sinus and by making a resection of the processus frontalis of the upper maxilla, the cells of the ethmoid which are nearly always affected, were rendered accessible. Killian's method, then, calls above all for a perfect resection of the anterior frontal wall. The lower wall of the sinus frontalis, that is the orbital plate of the frontal bone, is also completely sacrificed in all patients. The orbital contents thus take their share in filling up the empty spaces of the sinus and an excellent view may be had of even the most complicated septa and recesses in that region.

The most important part of the method, however, consists in saving the upper edge of the orbit in the shape of a bony margin or crest. This is cosmetically of the greatest importance. By being careful not to remove the periosteum further than the insertion of the tendinous fibers of the trochlear ring, double images can nearly always be avoided.

As it is absolutely necessary in every operation for chronic abscess of the frontal sinus to make a good opening into the frontal cells which are always diseased, a resection of the frontal process of the superior maxillary bone becomes a part of the method. This opens up all the cells of the ethmoid which are nearly always affected; the sphenoid sinus may be reached along this channel. The anterior end of the middle turbinated bone is plainly exposed and can be readily removed and a large communication between the frontal sinus and the nose is established. The nasal mucous membrane must be saved and is utilized in forming a flap to cover the defect. The wound is sutured either immediately or a few days afterwards.

Mr. W. E. S. presented himself at my office. Pus was oozing from the region of the glabella down to the root of the nose. Ten years previously he had noticed catarrhal symptoms. There had been profuse discharge from the nostrils and into the throat, whether in the upright position or lying down. After five years' suffering the amount of discharge was much increased. It was thick, milky and ill-smelling. At times there was severe pain in the forehead. He consulted a doctor in Eureka, who bored a hole into each frontal sinus through the vertical plate of the frontal bone a little to one side of the median line, and about three-quarters of an inch above the eyebrows. Silver tubes were inserted and constantly worn. They were open to the air. For a while all went well, though there was a copious discharge which he kept in abeyance by constant syringing. One year ago the right opening became narrow. The tube could not be put in and it gradually closed. The left side was successfully syringed all the time. Two weeks previous to presenting himself, dull aching set in on the right side, swelling became noticeable at the point of closure, and much pain was experienced for three days. Then perforation ensued, and the fistulous opening re-established itself. Since then the patient has been temporarily relieved, but wished to be definitely cured. The patient was found to be from healthy stock, 35 years of age. On the right side was a red, boggy looking, elevated ridge extending from a point 2 cm. above the nasal process of the frontal bone, upward 1½ cm. At its upper end is a fistulous opening from which foul smelling pus exudes copiously. Exuberant granulation tissue surrounds the opening, which is ragged, having been caused by a spontaneous rupture. Corresponding to this fistulous opening there is one on the left side above the superciliary ridge 2 cm. above the nasal process of the frontal bone 2 mm. in diameter. In it thick pus is seen pulsating. No particular swelling or inflammatory condition around this opening. The nasal mucous membrane is hyperannic. On the right side a spur on the cartilaginous septum touches slightly the lower turbinate. The left side is spacious. Under the middle turbinate on both sides creamy pus is noticeable which pulsates on the right side. The pharynx is normal but coated with a layer of pus. The patient has several bad teeth in the upper jaw. On the right side the posterior bicuspid, on the left side both bicuspids and three molars are bad. The naso-pharynx is comparatively free though the left tube protrudes somewhat. There is some creamy pus seen on the right side, at the base of the vomer. Transillumination revealed the right antrum entirely opaque; left side showed a slight tinge of brightness. Both frontal sinuses transilluminated slightly, there being a light area at the point of their artificial openings. The probe passed through the right fistula directly backward 5 cm., where it encountered a very sensitive bony resistance. It passed through the left fistula 4½ cm. until it encountered the same resistance. It passed in a downward direction about 3 cm. The probe can be passed directly backward only, with little lateral leeway. From the nose the probe passed into both frontal sinuses. A catheter could be introduced into the frontal sinus on the right side and solutions injected through the

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same passed out both external openings and also back into the nose. The condition of the ears is normal.

On October 2nd, the anterior end of the left middle turbinate bone was amputated and this allowed freer catheterization on that side. October 7th, the anterior end of the right turbinate was amputated. The discharge had freer outlet but continued nearly as profuse. No pus was elicited on syringing the maxillary antra through the natural openings, nor when exploratory puncture was resorted to.

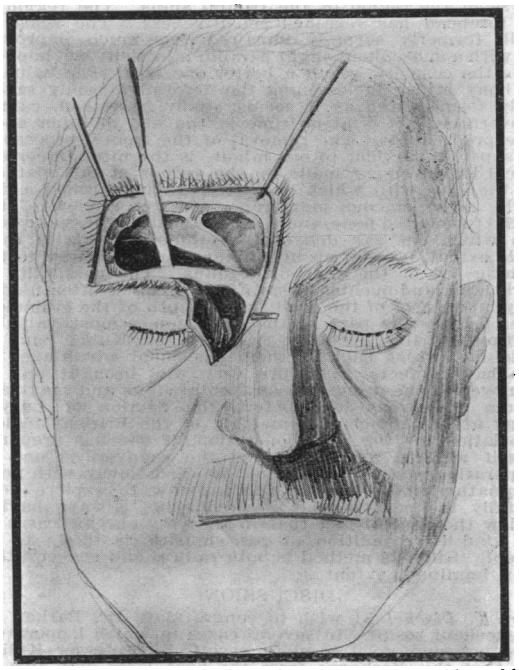

Fig. II.—Showing method of opening sinus on right side and bony bridge.

October 17th, patient entered the Lane Hospital. On the morning of the operation catheters were passed into both frontal sinuses and these were flushed out with boric acid solution. One-eighth of a grain of morphine was injected. Ether narcosis. Post nasal plug was applied under anesthetic and the whole rear part of the nose, and especially the middle meatus, were well tamponed. Anesthetic was now changed to chloroform. The eyebrows were not shaved. The right side was first proceeded with. Incision was made from the external angular process of the frontal bone on the right side through the center of the eyebrow, to its inner end and then carried in a graceful curve, downwards on the frontal process of the superior maxillary bone as far as the lower level of the lower end of the nasal bone. This incision went to the periosteum only. Considerable bleeding was checked with haemostats. The upper limit of the bony ridge was now determined by a cut through the periosteum parallel with the orbital ridge and at a distance of 4 or 5 mm. above it. This cut was carefully made, following closely the orbital margin with the finger. At the inner end this cut was to join with a similar cut on the other side at the base of the nose a few mm. above the upper end of the nasal bone. The periosteum was now elevated and with the overlaying integument was drawn upward. The tissue of the brow was loose enough so that the whole sinus on one side could be exposed through this wound. The upper limit of the bridge was then outlined with the chisel and the sinus was entered through the fistulous opening. It was found filled with granulation tissue and pus. A probe was inserted through this first opening to get the dimensions of the sinus to determine how far the periosteum should be reflected, and the limits of safety. The opening was enlarged with chisel and forceps, separating it very carefully from the bony bridge. The sinus was laid bare in its entire extent. The upper and outer angles were smoothed down with chisel and electric bur so that the integument lay flush against the posterior wall. Many small septa separating masses of pus had to be removed, and an enormous mass of stinking material was curetted out. The anterior wall of the sinus was then entirely removed. We now entered upon the second stage of our operation by carrying the original incision so far as it related to its downward curve; through the periosteum overlying the frontal process of the superior maxillary bone, up to near the insertion of the trochlea. The frontal process of the superior maxillary bone was now chiseled through very carefully. When an opening a few mm. in diameter was made the nasal mucous membrane was carefully pushed aside and the opening enlarged downward as far as the end of the nasal bone, by means principally of a cutting punch and chisel. The whole frontal process of the superior maxillary bone was thus removed. The nasal bone remained intact. The nasal mucous membrane, now lying as a floor to this quadrilateral window, was turned into a good-sized flap by separating it above and posteriorly. The flap was then drawn inward out of the way. Though the bleeding at this stage was considerable, it did not interfere with the continuance of the operation. A curet was now pushed downward through the osteum frontale into the nose and with this as a guide a wide communication was made with the frontal sinus. We now proceeded with the removal of the orbital roof as far as it formed a floor of the sinus. The upper lid, the orbital tissue and the periosteum lining the orbit were pulled downward and outward, good care being taken not to interfere with the pulley of the trochlea and to protect the orbital contents. With chisel and forceps the bony floor of the sinus, which was somewhat discolored and rather thin, was completely removed. The supra-orbital crest, covered by its periosteum, now stood out in good relief as a bony bridge connecting the root of the nose with the external angle of the frontal bone. A vast communication was thus established between the frontal sinus and the nose, the anterior ethmoidal cells, containing pus, being removed. The posterior cells, filled with pus, were freely curetted, until firm bony resistance indicated the posterior wall of the sphenoidal sinus. The operation was completed by holding the membranous flap outwards, by the introduction upward through the nose and into the frontal sinus, of a rubber tube of large calibre. After cleaning the wound, it was closed with interrupted celluloid sutures. The outer angle for the distance of 2 mm. was left unclosed and a strip of iodoform gauze inserted.

October 18th—At 8 P. M.: Temperature 99.8°, pulse 100, ⅛ grain of morphine and 1-30 of strychnia; October 19th—6 P. M., temperature 99.8°, pulse 100; October 20th, temperature 100°, pulse 76; October 21st, temperature 99°, pulse 88; dressing removed and strip of iodoform drainage changed; October 22nd, temperature 99.9°, pulse 76; considerable purulent discharge from the tube; dressing again changed; iodoform gauze saturated with purulent material.

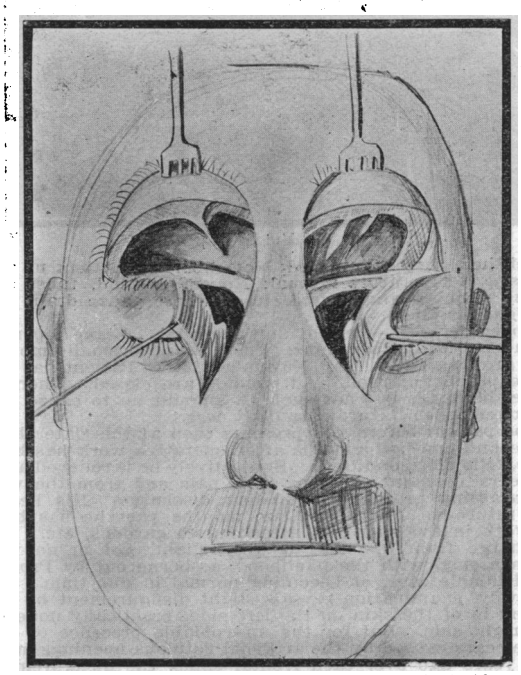

Fig. III.—Showing method of opening sinus on both sides.

October 23rd.—patient was now prepared for operation on the left eye. The counterpart of the operation on the right side was performed. The bone covering the frontal sinus anteriorly was chiseled away up to the point reached on the right side. The operation consumed much less time than the preceding and the wound was closed as before with celluloid sutures.

October 24th.—Returned to ward after operation; pulse 122, fairly strong; ¼ grain of morphine, strychnia 1-30; whiskey ½ dram; vomited small amount of blood; October 25th, after fairly comfortable night, vomited small

amount of bloody mucus; temperature 98.4°; October 26th, temperature 98.0°; pulse 100; patient's stomach would not retain food; peptonised milk per rectum; passed fairly comfortable night; wounds dressed; removed iodoform from both sides, saturated with pus; replaced them by shorter strips; the edema which had been present in the right lid following operation now disappeared; no diplopia; two drops of atropin in each eye; patient expectorates large amount of muco pus; October 27th, temperature 98.4°; pulse 100; edema of left lid still present; stitches removed from right side; wound perfectly healed, except where iodoform drains enter sinus; October 28th, temperature 98°; pulse 92; taking food by mouth and feeling fairly comfortable; October 29th, temperature 98.4°; pulse 80; dressing removed; several stitch-hole abcesses, which did not occur at all in the right side, are present; October 30th, temperature normal; takes nourishment well; dressing done; edema of lid nearly gone; stitches removed; October 31st, slept well and ate well;

Fig. IV.—Patient after operation.

stitch-hole abscesses healed; November 1st, patient up and dressed; temperature normal; November 22nd, tubes and gauze removed and wound closed where gauze drain had prevented union.

November 6th.—Patient left hospital. Large opening from nose into either sinus. Pus present in small amount, and growing daily less. November 10th.—Patient has become practically well. All wounds are closed. There is some discharge but not such an amount as to cause him inconvenience. Is growing daily less.

The patient before you presents then at this date about three and one-half months after operative work has been done, following condition. Subjectively he is relieved after 10 years' constant suffering from pain and from the very embarassing profuse, ill-smelling discharge. His health has returned. For about two months past he has been at work in the open air, attending to gardens, etc. The discharge from his nose is very slight, yet in no way embarassing, with the likelihood, as borne out by Professor Killian's case, of becoming normal in due time. Objectively, examination reveals slight disfigurement by the falling in of the skin on the left side, practically none on the right side. But for the unavoidable presence of two large scars caused by the artificial fistulous openings made five years ago over each frontal sinus, the disfigurement would be very slight indeed. As it has been borne out by a subsequent discussion, the general verdict is that, considering the excessively large sinus and the radical features of the operation, the cosmetic result as far as the forehead is concerned, is a good one. Even at this early date there is hardly any trace visible of that part of the scar which lies through the eyebrows on either side, and but a faint line, not a disfiguring one, at that of the incision over the frontal process of the superior maxilla. This bears out in our case to a very remarkable degree. Professor Killian's thoughtful location of the cut not only directly over those parts which give direct access to the affected sinus, but shaping the curve so that it follows in physiognomic harmony with the other lines of the skin in that region of the face. There is no trace visible of the large defect made by the resection of the frontal process of the superior maxilla. Practically there has been no diplopia at any time. No iritis, no lesion of the orbit and its contents of any kind. We feel satisfied that with due care and minutely following out Professor Killian's directions in this regard, the trochlea can be saved and the annoying symptom of diplopia prevented. Transillumination at this date shows a fair condition of the maxillary sinus, no transillumination as a matter of course in the region of the frontal sinus. The region of the forehead has regained sensitiveness. The sense of smell, formerly severely impaired, has much improved, and with a subsequent slight paraffin injection we hope to make the cosmetic result a better one still. The value of the bony bridge in lessening the deformity, easily saved, easily formed, and as it seems, easily nourished, cannot be overrated. It is at no time in the way of other operative proceedures. The removal of the frontal process of the superior maxilla, to our minds, is the most important radical improvement made by the author of this method. For the ease with which one, after having formed a flap of the nasal mucous membrane, can get a view of the middle turbinated bone, and reset it, the directness and ease with which one can deliver the ethmoidal cells in their whole extent, leading up in a natural and safe way to the cleaning out of the sphenoidal sinus. The possibility of overlooking and opening every affected cell so often hidden away in the roof of the orbit in the depth of the ethmoidal bone, makes this part of the operation a most valuable addition to the operative methods of Kuhnt and of Ogstonluc, which each of them has equal advantages as they have defects, a feature very well brought out by Lermoyez in the discussion on frontal sinus and maxillary antrum operations held before the Section of Laryngology at the Manchester meeting of the British Medical Association in 1902. The operation, if one has prepared himself well on specimens and the cadaver, is one of comparative ease. Work should proceed slowly with good illumination and with the end in view to explore very carefully the cells of the affected sinus, always having in view the clinical fact that in the very chronic cases of this kind the condition of pan-sinusitis is likely to be present. Killian's method is both radical and conservative to an imminent extent.

DISCUSSION.

Dr. K. Pischel.—I wish to congratulate Dr. Barkan on his excellent result. In several cases in which I operated, I had not such good cosmetic results. Professor Killian says that the discharge from the nose lasts only two or three months. In the last few cases it did not last so long because that canal which leads down from the frontal canal is covered with mucous membrane. The lower part should be covered with skin flaps just as we use them in the chronic otorrhoea where we cover the bone with skin flaps. Perhaps it will be possible to make a bone skin flap upwards and downwards after cleaning out the sinus. Cover the surface with skin. It has to be tried and might work. That would of course cause a much better surface and prevent falling in of the skin.

Dr. J. Denis Arnold.—I think that Dr. Barkan is to be congratulated in that he found a case so well adapted for this operation. I do not believe that either Killian or Barkan would recommend so extensive an operation for all cases of sinusitis of the frontal bone. Where there is necrosis, modern surgery suggests that all the bone be removed, and in complicated cases where all this is affected, the operation is well adapted. So far as cosmetic results are concerned, Dr. Barkan had bad features to deal with and his success is rather marked. Why originally this patient was so operated on as to leave two external sinuses, is hard to imagine. The first operation must have failed and catheters were then introduced. In all cases in which the lower floor is much involved it seems to me this operation is better than any other less radical operation.

Dr. Cohn.—The result in this case is especially gratifying, as Killian says in another publication, aided by Keimen in Berlin in 1900, that he would not undertake an operation in cases in which the cavities are large. In this case the size was appalling. Killian himself might have hesitated. Killian was not the first to remove both the anterior and inferior walls of the frontal sinus. Redel was the first who saw the necessity of removing both of these walls. Killian modified it by leaving a bony bridge. That is the essential feature of his operation. I agree that for radical cases this operation surpasses any other. It leaves good cosmetic results.

Dr. Nagel.—I should like to ask whether a bacteriological examination has been made. Of late years affections of sinuses become of great interest to the ophthalmologist. In some cases it is not known why the orbit and its contents are affected by affections of the lateral sinus. Bacteriological examinations are of great interest.

Dr. Gross.—The cosmetic result is very good indeed, considering the difficulties with which Dr. Barkan had to deal, and I might suggest that an injection of paraffin would do away with the remaining deformity.